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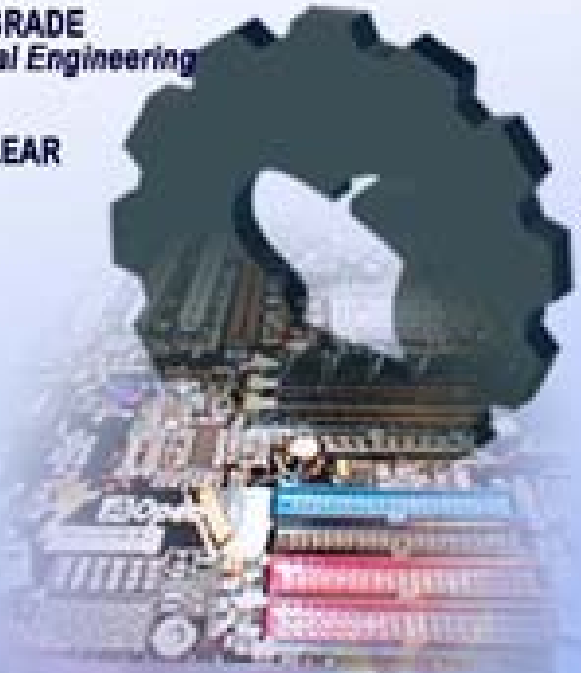

BOOK OF ABSTRACTS

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PRELIMINARY DESIGN AND THEORETICAL STUDY OF EARTH SHELTERED GREENHOUSES IN MOUNTAINOUS AREAS OF THE BALKAN

PART I: INITIAL CONSTRUCTION DESIGN- SOIL, WATER RUNNOFF MANAGEMENT AND LEGISTLATION

Balidakis Athanasios[1], Pavlou Ioannis[1], Kalabidis Dimitrios[1], Kotsopoulos Thomas[1]

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Abstract: *Greenhouse horticulture is a common crop cultivation practice in areas where the climatic conditions are convenient. Most of the greenhouse structures are established in areas where the landscape is plain and the construction is feasible. However there are many mountainous areas in the Balkan region that lack of the aforementioned parameters. In this case a higher cost of vegetable and other agricultural products and an imminent risk of food dependence in the future are probable. In this study a preliminary holistic approach of the construction and operation of earth sheltered greenhouses in such areas is presented, focusing on the Balkan region in terms of legislation, climate and land morphology. Earth sheltered greenhouses are a common cultivation practice applied in the mountainous regions of various countries such as China and India, but never investigated systematically for commercial purposes. The study is divided into two parts. As far as the first part is concerned the construction design and the parameters that must be taken into account concerning the water runoff of inclined areas are presented. The relative legislation which regulates that type of installations in mountainous regions of several countries located in the Balkan is also presented. That way it will be examined whether the proposed plan is feasible and if it can work as a quarry rehabilitation method.*

Key words*: Earth Sheltered Greenhouse, Mountain Region, Soil, water runoff, legislation*

CONDITION OF THE HORIZONTAL BOOM SPRAYERS IN PART OF THE MEDITERRANEAN REGION IN THE REPUBLIC OF MACEDONIA

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Abstract.*The Directive 2009/128 / EC of the European Parliament establishes a framework for the implementation of National Action Plan referring to the sustainable use of pesticides in every country. One of the areas covered by the Directive relates directly to the introduction of mandatory monitoring and inspection of pesticide application equipment. Considering that the Republic of Macedonia does not have a compulsory inspection, and as an EU candidate member country, is bound to harmonize its regulations, the basic aim of this research is to determine the current condition of the horizontal boom sprayers. The survey was conducted in a part of the Mediterranean region in the Republic of Macedonia, i.e. the municipality of Sveti Nikole and Stip. 43 machines were visually and operationally checked. The results of this research will be a good basis for further research and implementation of mandatory inspection of these machines in the Republic of Macedonia.*

Key words:*plant protection, pesticides, inspection, visual flows*

PHYTOECOLOGICAL CONDITIONS OF „БАЖБАН“ AND „КЫРГАН“ SAND MASSIFS OF WEST-KAZAKHSTAN AREA

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Abstract. *The work shows results of phytoecological assessment of degraded pastures in the West-Kazakhstan region, assessed via method of satellite recording and terrain studies decoding. Research and mapping of sand massifs has been conducted based on the comparative analysis of satellite recordings and terrestrial terrain recordings of landscape-ecological profiles. Developed landscape-ecological maps and profiles will enable better organisation of pasture rotation on the degraded areas, and the same can be used for environmental protection and preservation of pastures, by providing information to small households in what way to use the pastures the most effectively, in order not to endanger the ecosystem.*

Key words: *sand massif, satellite recording, decoding, pasture, landscape-ecological profile.*

THEORETICAL CALCULATION AND DESIGN OF A WATER ASSISTED EARTH TO AIR HEAT EXCHANGER FOR GREENHOUSE COOLING

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Abstract: *Greenhouse internal conditions must remain in certain levels in order to ensure that the crop will be developed properly. For this purpose several systems commercial systems are used for heating and cooling purposes. The most common cooling system used is the fan and pad system which is based on evaporation cooling. This method has relatively good results but in extreme hot conditions it might increase the humidity ratio within the structure in levels that might harm the crop. In this study an improved version of the earth to air heat exchanger is presented. In particular the system which has been studied for urban buildings and applications is adjusted to greenhouses. In order to enhance the cooling capacity of the system a second heat exchange process is taking place between the circulated air and drilling water. The methods of defining all the parameters that affects the internal climate such as temperature, humidity, air velocity etc are presented in this study, as well as, the technical elements required to do so. Also the system is illustrated in detailed drawings. For the scope of the study- the system's theoretical performance is compared with other systems' performance.*

Key words*: heat exchanger, cooling, greenhouse, resource management*

PRELIMINARY DESIGN AND THEORETICAL STUDY OF EARTH SHELTERED GREENHOUSES IN MOUNTAINOUS AREAS OF THE BALKAN/PART II: ENERGY MANAGEMENT, VENTILATION AND CROP DESIGN

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Abstract: *Greenhouse development is a common crop development practice in areas where the climatic conditions are proper. Most of the greenhouse structures are mentioned in areas where the landscape is plain and the construction is easy. However there are many mountainous areas in the Balkan region that lack the presence of the up mentioned parameters. That results to higher cost of vegetable and other agricultural products and the risk of food dependence in the future. In this study a preliminary holistic study for the construction and operation of earth sheltered greenhouses in such areas is presented, focus on the Balkan region in terms of legislation, climate and land morphology. Earth sheltered greenhouses are a traditional cultivation practice applied in mountainous regions in China, India etc but it was never studied systematically for commercial use. The study is divided in two parts. In this second part the energy study of the greenhouse operation is presented in terms of heating and cooling needs and operation requirements. Additionally the ventilation options are studied and presented in order to make the operation of the greenhouse effective. Finally the way that the crop will be developed inside the structure is also studied as the special characteristics of the structure require specific crop design installation in order to maximize the production rates. The study of such greenhouse structures can be proven very useful as it will give a design approach for greenhouse crop development in mountainous areas which have never been performed before.*

Key words*: Earth Sheltered Greenhouse, Mountain Region, Soil, water runoff, legislation*

THE ROTARY TILLER WORKING SPEED INFLUENCE ON OPTIMAL KNIFE PROFILE IN CASE OF REVERSE ROTOR ROTATION DIRECTION

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Abstract. *The optimal shape of the knife profile is determined by the value of the working speed ranges from 0.43 to 1.08 m/s. Constructional parameters and parameters of a rotary tiller tillage: the radius of the rotor (R=0.25 m), angular velocity (ω=16,038 s^{-1}) and working depth (a=0.1 m). The optimal shape of the knife profile for reverse rotor rotation direction is determined by using the parametric equations of the blade top trajectory and an arbitrary point of the knife profile. The profile of the knife is defined as the distance ρ that is base on determines corresponding coordinates X and Y. The first derivative of the function is the tangent of the angle between the tangent curve at the selected point Y (X) and the axis X. The value of the angle at the top of the blade (α) for testing working speed ranges from 4.61 to 10.51°. There is almost linear dependence between working speed and changes the angle α. By rotating the coordinate system for value of the angle α gets new uv coordinate system. Between the shapes of optimum profile of the knife in the rotated coordinate system uv differences are minimal. Curve knife profile can be writing by equation of the second and fourth degree.*

Key words: *Tillage, Rotary tiller, Shape of the knife, Working speed, Parametric equations, Nonlinear algebraic equations.*

TWIN ROW TECHNOLOGY FOR MAIZE SEEDING

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Abstract*: This paper presents the results of maize seeding with two different types of seeding machnes: standard – OLT PSK 4 and twin row – MaterMacc MS 8100 seeder. Research was carried out on experimental field of Agricultural faculty from Osijek (Klisa, Osječko – baranjska county, Croatia). Two maize hybrids were used: Zemun polje 488 (ZP 488) and Zemun polje 560 (ZP 560) in standard seeding with row spacing of 70 cm and in twin row seeding with row spacing of 22 cm (between plant lines) and 48 cm (between plat rows). The standard seeding for ZP 488 hybrid was performed on a predetermined set of 70297 plants/ha. Estimated set after emergence was 66 740 plants/ha. Yield of this hybrid with standard seeding was 14 055 kg/ha with st.dev. of 723.56 and c.v. of 5.23%. Yield with twin row technology was 15 028 kg/ha or 6.48% more than wth standard seeding. Predetermined set for this case was 71 544 plants/ha with 63 723 plats/ha estimated after emergence.The standard seeding for ZP 560 hybrid was performed on a predetermined set of 62 831 plants/ha.Estimated set after emergence was 53 073 plants/ha. Yield of this hybrid with standard seeding was 14 394 kg/ha with st.dev. of 319.84 and c.v. of 2.22%. Yield with twin row technology was 14 747 kg/ha or 2.40% more than with standard seeding. Predetermined set for this case was 63 346 plants/ha with 53 605 plats/ha estimated after emergence.*

Key words*: maize,yield, standard seeding, twin row seeding, twin row seeder*

AN IRRIGATION PREDICTION SYSTEM USING MACHINE LEARNING FOR PEARS

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Abstract. *Irrigation is one of the most important works in agriculture. Farmers have to visit their farm day after day to check whether the products need to be irrigated or not. Moreover, since decision of irrigation necessity is depending on experience and intuition of each farmer, it is difficult for another person to alternate the task of irrigation necessity decision. In this paper, we propose to introduce machine learning methods to learn the farmer's decision for irrigation necessity. The proposed method is a hybrid learning mechanism between supervised learning and reinforcement learning. For the reinforcement learning, the farm state is observed through the sensors installed in the farm. Moreover, the farmer's subjective records are collected for the supervised learning.*

Key words: *irrigation, prediction, machine learning, sensor, pear*

COMPARISON OF PESTICIDE APPLICATION QUALITY USING DIFFERENT TYPES OF SPRAYERS

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Abstract. *Quality application of pesticides means using minimum amount of protective liquid and its complete deposition on target surfaces. The procedure of pesticide application in perennial plantations is almost solely characterized by spraying process which uses air flow generated by the sprayer fan. The basic criterion of a successful pesticide application is the application and technical efficiency expressed through the distribution, retention and utilization of pesticide active substances. Classic sprayers with low-spray axial fans are dominant in local fruit growing practice.*
The testing included three types of sprayers, namely: classic sprayers with low-spray axial fan (A), recycling sprayers (B) and sprayers with backward angled air flow direction (C). The testing of the sprayers involved monitoring of: the amount of recycled liquid, pesticide deposit on the leaf surface and fruits, the amount of pesticide deposited on the soil surface and drift on the soil surface outside the working scope as well as drift made by floating of small droplets.
The main advantage of recycling sprayers is more efficient utilization of chemical agents and reduced soil contamination. The working fluid that does not reach the target surfaces is collected and returned to the tank, and drift is significantly lower than when classic sprayers are used.

Key words: *perennial plantations, types of sprayers, deposit, drift.*

SELECTION OF OPTIMAL TMA FOR SUPPLEMENTARY SOIL PROCESSING IN ORCHARDS AND VINEYARDS

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Abstract: *Increasingly pronounced climate changes create arid conditions, in which the local fruit and vine production is carried out without irrigation, imposing the need of soil processing on the entire planting surface. Due to the fact that supplementary treatment improves the water-air properties of the soil, breaks the crust, provides a favorable structure and destroys weed, it is necessary to apply the appropriate tractor machine aggregates. The adequate selection of aggregates from the standpoint of energy consumption is crucial for achieving high yields, the required quality and the necessary economical production in fruit growing.*

The subject of this paper is to define the energy and exploitation parameters of the basic tractor-machine aggregates used in supplementary soil processing for perennial plantations. The comparison of the obtained energy and qualitative indicators enables us to select the optimal aggregate for supplementary soil processing in perennial plantations. The results of examining the mechanization means in the supplementary soil processing of surfaces between rows indicate that the lowest fuel consumption is achieved by using a chisel plow (8.1 l / ha). By using it, it is possible to achieve a work depth of 12.3 cm, a speed of 6.89 km / h and a performance of 8.57ha/day with satisfactory quality.

For the sake of further savings in soil processing operations, it is necessary to form complex tractor-machine aggregates, which can perform working operations in one passage, while processing the soil.

Key words: *supplementary soil processing, tractor-machine aggregate, exploitation parameters.*

INFLUENCE OF NUMBER OF REVOLUTION OF DEVICE FOR PRUNING WITH CIRCULAR ON QUALITY CUTTINGS OF BRANCHS

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Abstract: *The paper presents results investigationof nbumber of rtevolution of divace for pruning with circular withdifferent of number of saw ttooth. Number of revolution was 500-2000* min^{-1}*. and number of saw tooth the circular is 60, 90 and 120. Diameter tghe circular is 483,5 -486,2 mm. Investigation of number of revolution of divace for pruning with circular saws with same diameter and different number of saw tooth shouved that* the best the best quality of cat was achieved with the option of circular saws with 120 tooth and 2000 min^{-1}. . Based on the research carried out, the quality of the cuttings with a description of the intersection in 10 points is also given.

Key words: Pruning, Number of revolution, Evaluationcut quality, Indicator.

EQUIPMENT DESTINED FOR THE CULTIVATION OF MEDICINAL AND AROMATIC PLANTS ON SMALL SURFACES

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Abstract: *Romania is characterized in statistics and in specialty works as being one of the richest European countries in terms of resources and potential for cultivating medicinal and aromatic plants. Here, over 50 species are cultivated in medicinal and aromatic purposes, with a tendency to grow. The fluctuations of profile markets, the type of ownership on lands, as well as the lack of specific equipment have determined the drastic decrease of surfaces cultivated with these species at national level and implicitly in agricultural exploitations. Growing demands, both on the internal market as well as on the external one, for medicinal and aromatic plants cultivated in "organic" systems call for the modernization and adaption of crop technologies to the current demands, complying with EU rules.*
The paper presents the results of tests in exploitation conditions, of two experimental models destined for the cultivation of medicinal and aromatic plants on small surfaces: sowing equipment and harvesting equipment. The results obtained constitute an important premise for achieving efficient technical equipment as well as for developing a system of machines specific for these plant categories. Also, indirectly, they can contribute to intensifying the cultivation of medicinal and aromatic plants in "organic" system, which has become increasingly attractive for small farmers in Romania.

Key words: *medicinal and aromatic plants, equipment, sowing, harvesting, agricultural exploitations.*

NEW HARVESTER OF FLOWER INFLORESCENCES FOR THE GERMAN CHAMOMILE

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Abstract: *New type of multifunctional Chamomile picker is designed for its direct harvesting of Chamomile inflorescences. Our guarantee of length of green stalks is up to 20 mm in an extent from 60 to 80 % of raw-material capacity. The Chamomile picker consists from the following functional parts: adapter for Chamomile flower picking, two under pressure pneumatically transporters, safety-related bin with ventilation against flower head damage. Chamomile flower heads are collected by the pneumatically transporters to accumulate bin under air cooling. Chamomile inflorescences into full bin are possible to transport for additional movement respectively for a next processing (a drying, sorting, cutting etc.).The main advantage of the new type of Chamomile picker is its application of engine (a driving unit) of easy available tractor (recommended – type VALTRA N123 respectively type FENDT), which is possible to use for multiplicity operating activities in agriculture, transport and building.*

Key words: *harvester, chamomile picker, matricaria recutita, tractor*

WORKING QUALITY OF TWO ROTARY MOWERS IN MOUNTAINOUS AREA

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Abstract. *Research results of two tractor rotary mowers, disc mower IMT 627.716 and drum rotary mower PZ Zweegers CM185H in cutting the first swath in grass clover mixtures are presented in this paper. The average yield of green mass was 38.10 t/ha. The aim of this research was to determine productivity, quality of work and losses made by different types of tractor rotary mowers in cutting the first cut of grass clover mixtures. In both variants the same operating unit Tractor LTZ T40AS was used. In the first combination tractor operated with drum rotary mower PZ Zweegers CM185H with max speed of 13,81 km/h, achieving performance of 2,30 ha/h. In the second variant tractor operated with disc rotary mower IMT 627.716 with max speed of 12,04km/h,achieving performance of 1,57 ha/h. At a given speed, the efficiency of work operations ranged from 0.90 to 0.97, averaging 0.93 in the first variant and 0.79 to 0.92, averaging 0.86 in the second version. Similarly, with the increasing speed of operation an increase in the average height of cut by given speed intervals from 5,97-6,41 cm for disc and 5,28-6,20 cm for drum rotary mower has been observed. Analogously with increasing of mowing speed occured the increase in total losses of 3.31 % to a maximum of 4.02 % of the total yield.*

Keywords*: drum rotary mower, disc rotary mower, operational productivity, cutting height, losses.*

SELECTION OF THE OPTIMAL TECHNICAL SYSTEM FOR POTATOES PLANTING IN CONDITIONS OF RASKA REGION

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Abstract. *Potato as a vegetable plant takes a significant place in the world food system. Potatoes are grown in Serbia in 80,000-90,000 ha, with average yields of about 10 t/ha, but the yield could be significantly increased with the use of modern technology in potato production. In order to achieve the best possible yield and thus profit, it is necessary to mechanize all processes in the production of potatoes. Among the most important processes is the planting of potatoes and it can be of crucial importance to the yield.*
Different results are obtained by planting with different types of planters, so that from the mentioned experiment we can conclude clear differences in the work, ie, advantages and disadvantages of certain potato seedlings, in this case semi-automatic and automatic planters.
For semi-automatic planters, the advantages are: the possibility of planting with a tractor less power, smaller compression area, smaller area for turning, less fuel consumption.
The disadvantages are: more labor force is needed, poor workers' position on planters, less effect, small space for planting material, more frequent addition of planting material, etc.
The advantages of an automatic planting machine can be stated as follows: better effect, required less labor, with a uniform calibration, almost no labor is needed, large volume of the plant space of the planters, less replenishment of planting material, etc.
The disadvantages of this plant are: more tractor power is required, using a larger tractor, we get a larger compression surface, requires a larger surface for turning, higher fuel consumption.
For future planting, automatic seedlings will be forced for the reasons just mentioned. With faster planting, there are more chances of planting in optimal agro-technical terms.

Key words*: mechanized potato production, potato planting, semi-automatic planter, automatic planter, Raska region.*

ANALYSIS OF PRODUCTION AND ECONOMIC RESULTS OF RAINBOW TROUT BROODSTOCK FARMING ON 3 DIFFERENT FARMS IN BOSNIA AND HERZEGOVINA, REPUBLIC OF MACEDONIA AND REPUBLIC OF SERBIA

Savić M. Nebojša[1], Hristovski Mišo[2], Aleksandar Trajčovski[2], Vaško E. Željko[1], Ostojić D. Aleksandar[1], Radojević L. Rade[3], Čanak M. Stevan[4]

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Abstract: *Rainbow trout (Oncorhynchus mykiss) broodstock farming for production of eggs for obtaining fry is increasingly losing on significance, both in the world and in the region. In the past 20 years, trend of purchasing eggs of rainbow trout in the stage of the eyes from the specialized farms is very expressed. The reasons for this practice can be found in the costs of keeping the broodstock and producing eggs, the organization of work on breeding the broodstock, as well as the possibility of purchasing eggs from specialized farms at any moment during the year, which is hardly achievable in own production. The analysis carried out on three fish farms in Bosnia and Herzegovina, the Republic of Macedonia and the Republic of Serbia showed that there are differences in technology and production results of rainbow trout broodstock breeding on the observed fish farms. With calculation based on direct costs, economic results of the broodstock farming were compared.*

Key words: *rainbow trout, broodstock, eyed eggs, production results, contribution margin*

NUMERICAL INVESTIGATION OF 2-D UNSTEADY, TURBULEND FLOW AROUND CONSTRUCTION FOR LOW REYNOLDS NUMBERS

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Abstract*: Microclimate around constructions and specifically the growth of small or large vortexes can significantly influence the quality of air, the thermal environment and the ventilation conditions of rural buildings. The formation, the size and the intensity of the vortexes which are result of the phenomenon of separation and reattachment of the boundary layer are influenced by the kind of flow (laminar or turbulent) and also by the building geometry. In this paper is presented the study of flow for two small Reynolds numbers, 250 and 500, around a two dimensional construction. The airflow is two-dimensional, unsteady and turbulent and simulates flow in a wind tunnel with a mathematical model of fluid viscosity, using the Navier-Stokes equations and the equation of continuity with specific boundary conditions. The DNS model is solved numerically by means of H / Y and the Galerkin finite element method. Instant and mean streamlines, instant and mean velocity distributions are shown and compared. Also, the separation and reattachment length for both Reynolds numbers are compared. The results are contradicted and qualitatively compared with results of other researchers.*

Key words*: vortex, Reynolds number, turbulent flow*

DESIGN OF HYDROSTATIC TRANSMISSION OF AGRICULTURE MACHINES

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Abstract. *This paper focuses on the use of hydrostatic transmissions for an agriculture machine. A hydrostatic transmission modifies and transmits power from the engine to the final drive, or directly to the wheels or tracks. An entire text could be devoted to the analysis required to properly match prime mover and load characteristics to achieve optimal productivity and efficiency. The objective in this paper is to understand the characteristics of a hydrostatic transmission so that it can be compared with mechanical transmissions.*

Key words: *servo pump, hydromotor, hydrostatic transmission.*

APPROXIMATE METHOD FOR THE ESTIMATION OF ENERGY PERFORMANCE OF HEAT PUMPS CONNECTED TO THE SYSTEM OF ENERGY MANAGEMENT OF FACILITIES

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Abstract. *Due to their efficiency heat pumps have found great application in the building industry, the process industry, in various technological processes in the production of food, to the space technology system, etc. When heat pumps are coupled to the energy management system which monitors and optimizes work parameters not only of the heat pump but also work parameters of other systems, such as solar and photovoltaic panels, thermal energy storages, electric batteries and the whole system, it is necessary to have a mathematical model that with sufficient accuracy and without great complexity estimates energy performance of the heat pump itself and the whole energy system. In this article a relatively simple mathematical model of a heat pump, with which it is possible to get values for the COP at any given time and under given conditions, was given. The obtained results of the model, applied to the air-water heat pump, used the input meteorological data of the mean air temperature for Belgrade, were presented. The verification of the obtained results of the model was made by using the catalogue data for the COP of the the Ecodan Monobloc Air Source Heat Pumps manufactured by Mitsubishi Electric.*

Key words: *heat pumps, Carnot cycle, modeling, energy management system.*

ELECTRO-HYDRAULIC DRAFT CONTROL SYSTEM FOR MASSEY FERGUSON 285 TRACTORS

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Abstract. *A directional and proportional flow control valve with electronic control ability was designed and installed on the Massey Ferguson (MF) 285 tractor hydraulic system. The hydro–mechanical draft control system was changed to the electro-hydraulic by using this valve. In this system, a potentiometer for the depth measurement, a tensile load cell to measure the draft force, a CP1L-J14 model of the Omron PLC to signal processing, a Programmable Terminal as control panel and the stepper motor with driver as actuator to control the valve were used.*
The result of transient response experiments showed the stability of the system in depth control when the draft force was kept in the constant value or less than the lower limit of the dead zone. Field experiments were done in randomized complete block design with three replications. The treatments included: two control systems (mechanical and electro-hydraulic), three ground speeds (V1= 2.5, V2= 3.6 and V3= 5 km/h) and three draft set values (d1= 6, d2= 8 and d3= 10 kN). The measured parameters were: fuel consumption, wheel slip, draft force, rolling resistance and implement working depth.
The results showed significant difference between two control systems in fuel consumption and wheel slip ($P<0.05$). But there weren't significant difference between tractive efficiency and tillage depth values in both control systems ($P<0.05$). The electro- hydraulic draft control system decreased the fuel consumption and slippage by 44.6% and 29.3% respectively at the maximum draft set value and ground speed, compared to the mechanical draft control system.

Key words: *tractor, sensor, electro-hydraulic draft control, slippage, fuel consumption.*

INFLUENCE ON GAS EXHAUST EMISSION AND ENERGY EFFICIENCY FROM DIFFERENTE WORKING REGIME OF TRACTOR KUBOTA M135GXS

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Abstract. *This labour studies energy balance, energy utilization rate and share of energy that goes to the basic soil treatment in the total energy inputs required for the production of mercantile maize in differente working setup of the tractor M135GXS. It will also provide an analysis how differente working setup and in what percentage influence on the exhaust gases of the engine, where included nitrogen oxides NOx, nitrogen dioxide NO_2, carbon monoxide CO and sulphur dioxide SO_2, mesured with the portable gas analyzer Testo 350.*

Key words: *agricultural tractor, working regime, energy, emissions*

STATIC STABILITY OF AGRICULTURAL TRACTOR

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Abstract. *Modern agriculture can not be imagined, among others, without the tractor, as well as many self-propelled agricultural machines. However, although all of them are inevitable in crop and livestock production nowadays, they are also fairly often associated with dangerous accidents that can lead to serious workers injuries and even to death. A wide variety of different types, models and designs for agricultural tractors and self-propelled machines has been developoed in the past, but the basic principles of their static and dynamic stability remain identical nearly all the time. Having in mind that many factors influence the stability of agricultural tractors and machines, it becomes clear that carefull analysis is neccessary to prevent possible causes that can trigger the mechanism of their overturning.The only safe way to reduce the potential for an overturn incident is directly related to better understanding the stability of agricultural self-propelled machines. Analysis of this kind should indicate preventive corrections of tractors design, in order to increase the safety of its application. Following this approch, in the present paper is experimentally tested and analyzed the static stability of very old, but still very popular in Serbia, model of agricultural tractor IMT 539. Static stability is related to the maximum slope angle of flat terrain, which still guarantee that tractor will not overturn. Measurements of this kind are very important not only for the practical purposes, but also because they provide data basis for development and testing of various simulation models specified for estimation of angular stability range of agricultural tractors.*

Key words*:agricultural tractor, stability, agricultural maschines, overturn hazard*

COMPOSITE INDICATIORS CONSTRUCTION IN CASH FLOWS MILK PRODUCTS BASED ON IVANOVIC DISTANCE

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Abstract. *The aim of this research is using the statistical approach to composite indicators construction based on Ivanovic distance (I - distance). An indicator or index represents a quantitative or qualitative measure that comes from a series of facts, and is able to relative information about the entities and their positions in the area of interest, allowing for their mutual comparison and ranking. Ranking of entities is a very popular topic. In this research we use this method for cash flows. In order for a company to make a profit, you need to have much investment. However, this rule is often in conflict with the need to hold cash that is needed to maintain the company's liquidity. In this sense, there are three groups of costs: the opportunity cost of holding cash (missed yield, cash on hand and current account makes no yield); expenses for transactions with cash (administrative costs, commissions, credit insurance costs, costs of issuing commercial papers, registration costs, in fact, the cost of flotation of securities); the cost of the lack of cash. The research was done at the company Milkop DOO from Raska.*

Key words: *composite indicators, Ivanovic distance, cash flows, milk products.*

TECHNICAL REVIEW ON PROPERTIES, UTILIZATION AND DRYING OF APPLE POMACE

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Abstract: *Apple pomace is one of the byproducts of the juice industry and represents a huge waste of biomass. According to many authors, the apple pomace comprises round 25% of overall mass of the fresh apples used in juice industry. Not only it represents a huge waste of useful material, but there is also an emerging problem of its disposal. In order to perceive all the benefits and possibilities of the apple pomace utilization, a review was needed to be written. This article describes the properties of the apple pomace and its potential uses. Furthermore, the drying process of apple pomace was reviewed as one of the best ways for preserving food and organic materials. The different drying methods and parameters of the apple pomace were reviewed.*

Key words*: apple pomace(AP), AP properties, AP applications, drying*

CONVECTIVE DRYING OF BLUEBERRIES: EFFECT OF EXPERIMENTAL PARAMETERS ON DRYING KINETICS AND MATHEMATICAL MODELING

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Abstract. *The hot air convective drying characteristics of thin layer blueberries (Vaccinium corymbosum) were evaluated in a laboratory scale dryer. The drying experiments were carried out at 60, 70 and 80°C and the air velocity of 0,5 and 1,5 m/s. The convective drying process of raspberries took in falling rate period, and drying time decreased with increasing air temperature and air velocity. The experimental data obtained during the drying process were fitted to five different mathematical models. The Midilli et al.s model was found to best appropriate model for explaining the drying behaviour of raspberries convective drying. Effective moisture diffusion coefficients were calculated by Ficks diffusion model and their values varied from 9,66 x 10^{-12} m^2/s to 9,67 x 10^{-11} m^2/s. It was found to increase proportionally with the increase in air drying temperature and air velocity.*

Key words*: blueberries, air drying, mathematical modeling.*

DETERMINATION OF VOLATILE COMPOUNDS IN SERBIAN RED WINES FROM CABERNET SAUVIGNON, FRANKOVKA AND MERLOT VARIETIES

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Abstract. *In this study, the volatile composition of six red wine samples of different grape varieties (Cabernet Sauvignon, Frankovka and Merlot) and vintages originating from Serbia were investigated by detailed GC-MS analysis. In total, the analyses allowed the identification of 39 compounds in the extracts, accounting for 94.9–97.1% of the detected GC peak areas. No significant differences in the volatile composition were observed among the six wine samples. The most abundant aroma compound in all wine samples was 2-phenylethyl alcohol, a well known product of yeast metabolism responsible for flowery notes of wine aroma. Identification and origin of the other volatiles present in lesser amounts and their contribution to the wine aroma characteristics were also discussed.*

Key words: *Wine, GC-MS, Volatile Composition, Cabernet Sauvignon, Frankovka, Merlot.*

POTENTIAL AND LIMITATIONS OF PLUM DRYING AND SALES: CASE OF OSEČINA MUNICIPALITY

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Abstract*: The sale of processed products to suppliers brings higher value than the sale of fresh products, which is the main motive for investing in plums drying. The Municipality of Osečina is perhaps the best example of prune sales profitability since it cultivates orchards of plum trees, the tradition of plum drying, while a great number of new plum drying facilities were built and in the last few years. The reason of such development in the municipality of Osečina is primarily a foreign demand for prunes. The subject of this paper is to examine the potential and limitations for drying and selling dried plums. The data for this research were collected from personal interviews with key stakeholders in Osečina engaged in the plum production or drying. A person employed in the advisory department and the person in charge of the organization of the Plum Fair that is held each year in Osečina in August have also been interviewed. Finally, the National Statistical Office data were also used. This paper shows, in particular, that 94% of plum drying facilities in Osečina have the daily capacity for drying of up to 1000 kg of plums, other than for drying of other fruits and finally, the production of fresh plums in the municipality ensures the operation of a drying facility for half a month during the year.*

Key words*: prunes, drying, sales, Osečina.*

TECHNICAL REVIEW ON THE APPLICATIONS OF ULTRASOUND IN AGRICULTURAL SYSTEMS

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Abstract*: Ultrasonics is new science that is being intensively developed in recent years. Sound velocity is a valuable engineering tool and non-destructive, non-invasive, non-intrusive technique of measurement. The various effects of ultrasound were discussed and outlined in a context of different uses to accelerate or support agricultural production processes like: vibrational and heating effects, cavitational effects, speeding up biochemical processes, mutagenic effects, etc. Special attention was paid on crystallization and separation processes in operational engineering. This paper presents a review of ultrasonic wave application in agricultural production and modern agricultural systems.*

Key words*: Ultrasonics, ultrasound waves, agriculture engineering, bio systems engineering*

NUTRITIONAL AND ENERGETIC VALUES OF HARD CHEESE WITH ADDED VALUE

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Abstract. *Nutritional and health values of cheese depend on the milk quality and type of cheese. Hard cheese contain nutritionally important and beneficial components, provides energy and significant amounts of protein and micronutrients. Progressive breakdown of casein during cheese ripening may increase the digestibility of cheese and also amount of beneficial bioactive peptides and free amino acids. Quality control of dairy products is particularly important for public health and safety. In this paper, microbiological safety of cheeses was investigated. Cheeses were tested for the presence of Listeria monocytogenes and coagulase-positive Staphylococci as well as Escherichia coli and Enterobacteriaceae was examined. Standard chemical analyzes were performed and the pH of cheese samples was determined. Data were statistically processed using Microsoft Excel 10.The results of the microbiological safety in all tested full-fat hard cheeses, produced from pasteurized milk, showed that the cheeses appeared as satisfactory in terms of microbiological, hygiene and safety criteria. Cheeses contained on the average 28.00% milk fat, 23.69% proteins, 2% lactose and pH value of 5.24. Regarding fat content on dry matter basis (FDM), its average content was 48.03%, while moisture in non fat substance water (MNFS) was 49.07%. The energy value of cheeses amounted to 1473/352 kJ/kcal.The role of milk and dairy products in human nutrition has been increasingly debated in recent years. However, it is certain that the cheese is an important source of valuable nutrients and energy and should possess priority in human diet.*

Key words: *hard cheese, microbiological quality, nutritional value*

APPLICATION OF STATISTICAL INDICATORS IN IDENTIFYING AGRICULTURAL PRODUCTS DURING SORTING

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Abstract*: Computer vision is a rapid, economic, consistent and objective techniqueof recognition, whichhas expanded in the agricultural and food industry, including the inspection and grading of fruit and vegetable. The differences in color and other morphological properties can be detect in a different range of electromagnetic wavelengths, depending on which cameracolor sorter has. The optical system can be composed of several camera and lasers, which further increases the robustness and price of sorter. The aim of this paper is to find a criterion that would simplify the procedure of recognition good products only based on camera shots, without use of an additional device. For the initial research, a set of images were taken during industrial processing of raspberry. Based on images, checking statistical indicatorswas performed and correlations between them. Further, an algorithm was developed in Matab, and the result is that over 80% of a good products are recognized.*

Key words*: optical sistem, color, image processing*

THE EFFECT OF FREEZING IN DIFFERENT TUNNELS ON THE QUALITY OF BLACKBERRY FRUITS

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Abstract. *Freezing is considered as one of the most important technology to retain fruit quality. The industry of frozen food is very important for developing countries, in which the fast freezing technology is rapidly developed. The purpose was to study the effect of freezing in different tunnels on the quality of blackberry fruits and relationship between quality groups after freezing. The four types of tunnels for freezing under industrial conditions were analyzed: batch freezer, fluidizing freezer, spiral belt freezer and cryogenic freezer. Examination was realized on blackberry variety Thornfree, which has the best characteristics for freezing. Blackberry fruits frozen in different tunnels have different relationship between quality groups i.e. quantity of rollend, block, crush and freezing shrinkage. The obtained results indicate that the best quality of blackberry fruits was detected after freezing in the cryogenic tunnel. Differences in energy consumption for freezing of blackberry in the different tunnels are also shown.*

Key words*: freezing, tunnels, blackberry, quality, energy consumption.*

SALVIA HISPANICA L. AND WALNUT OIL AS A FUNCTIONAL SUPPLEMENT OF INTEGRAL BISCUITS

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Abstract. *Salvia hispanica L. is a one-year plant that has been in use since the time of Acteks in the territory of today's Mexico. It has been forgotten for centuries, but with the growing demand for new nutritive high-quality foods, it has become a matter of interest and research. The specific nutritional value of the seed provides high content of α-linolenic acid and dietary fibre. This paper examines the changes in the nutrition and sensory properties of biscuits with chia seeds. On the basis of integral millet flour in combination with integral wheat flour and oat flakes, biscuits were produced. Walnut oil with high content of polyunsaturated fatty acids was used (iodine number 90.7 gJ_2 /100 g). In addition to the control sample, samples with 14 and 28% of chia seeds were prepared. The increase in the chia seed content in the formulation of biscuits increased the content of mineral substances (by 10 or 18.8%), the content of total fats decreased (by 7.9 and 8.85%), while the content of protein and sugar remained almost unchanged. The addition of seeds in the sensory aspect affects the appearance, texture (structure) and chewiness of the product. Even though overall sensory quality somewhat declined with respect to the control sample, the biscuit with the chia seeds was of a very good quality (weighted mean value of the score is 4.4 and 4.2).*

Keywords*: Salvia hispanica L., walnut oil, integral millet flour, biscuits*

ADVANCES OF FREEZE-DRYING IN PRODUCTION OF FUNCTIONAL INGREDIENTS FROM RASPBERRY AND BLACKBERRY

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Abstract *The aim of this study was to investigate potential application of dried and milled raspberry and blackberry as food ingredients. Fruits were dried by convective drier and freeze-drier in order to compare influence of drying methods on different characteristics of final product. After milling of dried fruits, fruit powders were added into oilseed rape honey in different ratios (5, 7 and 10 %w/w). Storage stability was analyzed in case of dried fruits as well as honey with functional ingredients at 25 °C in dark place.*

Results have shown that freeze-dried samples were significantly better in term of physical, chemical and sensorial properties. Process of milling was more efficient in case of freeze-dried samples. Fruits dried by freeze-drying had higher bulk and tapped density due to the higher volume in comparison with convective dried fruits. However, fruit powders produced by freeze-drying had lower tapped density and water activity (a_w<0,3), which are very important characteristics for food processing. In addition, color stability of the freeze-dried samples was achieved since drying in cabinet drier significantly affected degradation of anthocyanins as main color components in examined berries.

Sensorial evaluation has shown that best results were achieved with addition of raspberry powder produced by freeze-drying into oilseed rape honey in ratio of 10 %w/w.

Fruit powders could be used in various food products as functional ingredients due to high content of vitamins and phenolic compounds which are very sensitive. Freeze-drying is a suitable method for production of dried forms without losing of bioactive compounds.

Key words: *Freeze-drying, convective drying, raspberry, blackberry, oilseed rape honey*

VEGETABLE FROZEN DESSERT PRODUCED WITH CHIA SEEDS (*SALVIA HISPANICA* L.) AS BINDING AGENT

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Abstract. *Thanks to its outstanding composition, i.e. the valuable proteins, oil, dietary fiber, antioxidants and minerals, chia seeds (Salvia hispanica L.) regained the interest of health conscious consumers. Besides, chia has very prominent hydrophilic properties. The fact that it absorbs more than twelve times its weight in water, and exude a mucilaginous gel when soaked, induced the idea of making a frozen dessert with chia seeds as a gelling and thickening agent. A mixture of almond milk, honey, fresh raspberries was bind with 7% and 13 % of chia seeds, and subsequently analysed. The sample with 13% of chia seeds showed increased amounts of fat and protein, as expected. On the other hand, it contained lesser amounts of water and sugar, which can be attributed to the binding ability of the seeds and their low sugar content, since almost all carbohydrates are present in the form of dietary fiber. The results of the sensory analysis indicate that both tested samples belong to the category of very good quality. The sample with 13% of chia seeds received higher scores for appearance (color), firmness, melting rate, mouthfeel and taste, which was the reason for its position at the very border with excellent quality (X_m=4,45). This also suggest that larger proportion of chia improved the sensory perception of the final product. Using chia seeds with other valuable components, a nutritious, vegetable, gluten-free, frozen dessert was obtained, which confirmed the functional properties of the chia seed, as a very good binding, thickening and gelling medium.*

Keywords: *chia seeds, functional properties, frozen desserts*

IMPROVING THE FREEZING PROCESS OF RASPBERRY FRUITS IN INDUSTRIAL CONDITIONS

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Abstract. *Raspberry belongs to the group of non-climacteric fruit whose periods of physiological and technological maturity match. These properties of the fruit species provoke sensitivity of fruits and susceptible to rapid decay. The quality of the fruits begins to decline from the moment of harvest, whereupon fruits tend to lose firmness and freshness, the occurrence of mold and rot if fruits are not kept under adequate conditions. Therefore, all technological procedures upon harvest are intended to prevent fruit decay and reducing fruit quality accordingly. For this purpose, process of freezing is commonly applied procedure worldwide for preservation of raspberry fruits. The paper presents how the process of freezing of the raspberry fruits can be improved by introduction of new operations into the technological process. The raspberry freezing process in flow-freeze tunnels (fluidizers), which have considerably higher daily capacity compared to conventional tunnels, is employed mainly in high-capacity cold storages. Introduction of more advanced processing equipment can significantly improve efficiency of freezing process of raspberry fruits, which is reflected in larger amounts of IQF, i.e. obtaining a significantly higher quantity of high-quality frozen raspberry fruits, which are more competitive on global market and have a much higher price.*

Key words*: raspberry, freezing, equipment, quality*

INMPACT OF THE SENSOR HIGH IN THE MEASUREMENT OF THE CORN VEGETATIVE INDEX

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Abstract. *This paper presents field scouting of corn in order to determine the content of nitrogen in the green parts of the plants. The aim was to measure the vegetative index using two optical sensors by OptRx AGL Technology. The sensors are positioned at a distance of 3.5 m, individually observing five rows of corn. The sensors are designed and constructed to allow sensors to be moved in altitudes relative to the ground and the green part of the plant, adjusting is manual, so that the height of the sensor varies from 50 to 70 cm above the plants, or at 5 different distances for 5 cm shifts. The speed of movement of the tractor also varied. The measured vegetative index of the plants is correlated with the height of the sensor. It was noticed that the correlation exists, but that it does not significantly affect the mapping of nitrogen content.*

Key words: *optical sensors, corn, Nitrogen, NDRE*

EXPLOITING SENTINEL-2 MULTISPECTRAL, LANDSAT-8 SURFACE REFLECTANCE, AND SENTINEL-1(SAR) SATELLITE IMAGERY FOR CROP CLASSIFICATION AND MAPPING IN ITALY

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Abstract: *Italy is considered one of the developed country in the field of agriculture. For many reasons, reliable classification and crop mapping plays an important role in Precision Agriculture. In literature many solutions have been proposed to classify crop using images/data acquired from various satellites equipped with various active and passive sensors such as Spectroradiometer, Multispectral imagery sensors, Synthetic aperture radar (SAR) and Hyperspectral radiometer. In this work, it has been exploited and validated the feasibility of high spatial resolution multispectral optical sensor (Sentinel-2), multitemporal satellite synthetic-aperture radar (Sentinel-1) and Landsat-8 for classification of crops. Critical features are extracted from both optical and SAR images and used for the classification purpose. Various classification techniques are applied on the data acquired from sensors. Ground survey is conducted to validate the classification results and accuracy of this work with in the area of interest.*

Key words: *precision agriculture, crop classification, satellites, multispectral optical sensors, synthetic aperture radar.*

INFLUENCE OF THE SENSOR HIGH AND GROUND SPEED OF TRACTOR IN THE MEASUREMENT OF THE CORN VEGETATIVE INDEX

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Abstract: *This paper presents field scouting of cornin order to determine the content of nitrogen in the green parts of the plants. The aim was to measure the vegetative index using two optical sensors by OptRx AGL Technology. The sensors are positioned at a distance of 3.5 m, individually observing five rows of corn. The sensors are designed and constructed to allow sensors to be moved in altitudes relative to the ground and the green part of the plant, so that the height of the sensor varies from 50 to 70 cm above the plants, or at 5 different distances for 5 cm shifts. The speed of movement of the tractor also varied. The measured vegetative index of the plants is correlated with the height of the sensor and the speed of movement. It was noticed that the corelation exists, but that it does not significantly affect the mapping of nitrogen content.*

Key words: *optical sensors, corn, nitrogen, vegetative index, map*

INNOVATION AND MULTIDISCIPLINARY APPROACH FOR DEVELOPING INNOVATIVE IT CONTROL SYSTEM FOR WATERING OF GREEN HOUSES

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Abstract. *Innovation aspect of developed control system is asked on the needs of the agricultural producers on the specific area. In the area of the Novi Pazar and surrounding municipalities most producers have small number of green houses, which are often on the scattered over hilly and hard reachable terrain. On the global level there are existing solutions which integrate automatic watering systems with advanced monitoring of the different aspects of the green house conditions. On the National level only existing system is Smart Watering System which is system specialized for the Fruit production and management system is based on the SMS messages through cellular network providers. Innovation and multidiscipline approach are of the essence in the modern world, IT technologies are involved into controlling wide number of the processes. Emerging open source and cheap platforms as Arduino enable small teams to develop cheap and reliable control systems. In this work authors gave overview of the process which can be used for the development and implementation of control systems in agriculture.*

Key words: *innovation, control system, arduino, green houses, watering*

INFLUENCE OF GREEN WALLS ON BUILDING MICROCLIMATE IN MEDITERRANEAN REGION

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Abstract. *Urban Heat Island is one of the most typical phenomena of climate in cities and metropolises where air temperature is higher up to 6°C in comparison to the surrounding suburban and rural areas. The main parameters influencing the building microclimate are: external air temperature and relative humidity, incident solar radiation, long wave radiation exchange between the building surfaces and its surroundings, incidence and speed of the wind, air exchanges, physical and thermal properties of the building's envelope materials, design variables such as building dimensions and orientation, presence of artificial light, electrical equipment. The green technology can represent a sustainable solution for construction of new buildings and for retrofitting of existing buildings, in order to reduce the energy demands of the buildings' cooling systems, to mitigate the urban heat island and to improve the thermal energy performance of buildings. Green walls can allow the physical shading of the building and promote evapotranspiration in summer and increase the thermal insulation in winter. In summer the efficacy of greenery systems is achieved for all the climatic areas of the world while the performance of the greenery systems is strongly influenced by the climatic conditions in winter. In literature there are experimental data at real scale concerning short periods. An experimental test was carried out at the University of Bari (Italy) for two years. The aim of this paper is to analyze experimental data for a long period in the Mediterranean region. Three vertical walls, made with perforated bricks, were tested: two were covered with evergreen plants (Pandorea jasminoides and Rhyncospermum jasminoides) while the third wall was kept uncovered and used as control. Several climatic parameters concerning the walls and the ambient conditions were collected during the experimental test. The daylight temperatures observed on the shielded walls during warm days were lower than the respective temperatures of the uncovered wall up to 9°C. The nighttime temperatures during the cold days for the vegetated walls were higher than the respective temperatures of the control wall up to 6°C.*

Key words: *Thermal insulation, urban agriculture, urban heat island, air-conditioning, energy savings*

THE EVOLUTION OF THE AGRICULTURE IN THE YEARS

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Abstract: *The entrance of the agriculture in human history has been one of the most significant phases of man existence since it has revolutionized his way living; the abandonment of nomadic life and the increase of sedentary groups have influenced the economy, the social relations and the political structures.*
The human continuous evolution, together with the scientific and technological innovation, has led to numerous changes in the conduct of agricultural practices; so, from the simple cultivation of the land, which was the first important man's attempt to control and dominate nature, man has began to work very punchy rhythms and to violate the laws of nature, until to develop of genetically modified organisms (GMOs). Fortunately, over time, man has realized that in order to safeguard history, nature and his own life, must necessarily recover the traditional and typical forms of agricultural civilization. This paper shows the most important changes that happened over the centuries that have characterized the evolution of agriculture. The analysis of the statistical data on the cultivated agricultural surfaces show their general reduction and the trend of increasing the areas cultivated according biological practices.

Key words*: agricultural evolution, traditional and biological agriculture*

RESULTS OF THE EXAMINATION OF CONE RESISTANCE AND EFFECTS OF SOIL COMPACTION CHANGE ON YIELD OF WINTER WHEAT

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Abstract. *The big ecological problem in plant production is soil compaction, which is a consequence of the mechanization and movement of people. The consequences of excessive soil compaction are manifested through the reduction of porosity of soil, volume, productive ability of the land and adverse effects on the development of plants and yield. The paper presents the results of measuring the penetration of the cone during penetration at a depth of up to 30 cm and the effect of changes in soil compaction on the yield of winter wheat. Tests were carried out in the conditions of central Serbia, and the compression was measured by a penetrologer Eijkelkamp 6.0, by pressing the cone of the surface 1 cm^2 with the tip of the cone 60^0, in accordance with the standard EN 5140. The cone was standard in size according to the standard ASAE S313.1, while the humidity of the soil is measured with Theta probe. The soil partition was measured on the inner part of the parcel and after the planting in the emergence stage, before harvest and after harvest, and the obtained values were compared with the control (plowed soil). The aim of the research was to determine the effect of soil compaction on changes in cone resistance during penetration and the amount of yields achieved. The obtained results show that on the inner part of the plot during the emergence phase the increase of the cone penetration at the depth of 5 cm was 46,53% larger , and 87,25% larger on the slopes in relation to control. The increase in soil compaction has had a major impact on yield reductions, so the yield of winter wheat was lower on average for 37,8% on the slopes in relation to the inner part.*

Key words*: cone resistance, compaction, soil, yield, wheat.*

PHYSICAL PROPERTIES OF ORGANIC FERTILISER PELLETS

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Abstract. *The aim of this study was to analyze the selected mechanical properties of the organic fertilizer pellets as the base parameters for the depositor's production. During the test was using a commercial organic fertilizer pellets properties bulk density of 646.1 kg/m^3 and a humidity of 17.50%$_{wb}$. Physical properties depend to a large extent on the moisture content of the organic fertilizer pellets. The tests were carried out for pellets moisture content ranging from 4.48 to 20.81%. For lower pellets moisture content the values of mechanical properties (Hardness and Work Input) increase. The value of the static friction angle increased approximately linearly with increasing pellets moisture content and ranged from 18 to 24.5°. From a point of degradation rate, pellets granules larger than 4 mm showed high quality. Originally the organic fertilizers pellet contained 5.20%, scattered fraction. After application trough the depositor share of the scattered fraction mass increased to 13.55%. The indicated pellets damage does not affect the quality of the depositor's work.*
Based on the investigated physical properties of organic fertilizer pellets, a depositor was constructed, and successfully applied organic fertilizer pellets in practice.

Key words: *pellets, organic fertilizer, physical properties, mechanical properties, static friction angle, degradation rate*

FABRICATION AND APPLICATIONS OF MULTIFUNCTIONAL NANOSTRUCTURED TIO_2

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Abstract. *Nanomaterials development is a rapidly emerging field of research with enormous potential for societal and economic benefits. In agro and food industries dimension-dependent properties or phenomena of nanomaterials may be used for various functional effects such as increased bioavailability or decreased toxicity of products, better detection of pathogens, improved food packaging materials, or improved delivery of nutrients. Since these effects may derive from altered or unique characteristics of materials in the nanoscale range that are not normally observed or expected in larger-scale materials with the same chemical composition, such changes raise questions about the safety, effectiveness, performance, quality or public health impact of nanotechnology products. In this article we have reviewed the fabrication, properties, and selected applications of nanostructured TiO_2 based materials. Special attention has been paid to TiO_2 nano particles and nanotubes fabrication perspectives and their applications in agriculture. We have shown that high photocatalytic disinfection and photo biological effects of nanostructured TiO_2 coupled with its low price, nontoxicity, and stable performance especially provide new approaches for solving environmental pollution and pesticide residue problems in agriculture.*

Key words*: nanomaterials, nanoparticles, nanotubes, TiO_2*

STATE OF THE EUROPEAN MARKET OF TOWED AGRICULTURAL VEHICLES AND MACHINERY

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Abstract.*Trailed machinery and transporters with various types of suspension account for a large proportion of the manufacture and sale of agricultural machinery in Europe. These trailed vehicles cover a wide functional range: agricultural trailers, tanker trailers, trailed fertilisers and manure spreaders, sprayers and fodder mixing wagons. They also have many different types of suspension: tandem, tridem, sprung, rigid, steered, etc.Of the product groups under examination, those with the highest levels of sales in terms of number of units were round balers, trailed sprayers and fertiliser spreaders. There is also a substantial market in large square balers, but rather than the number of units, it is the value of machines sold that is significant.*

Key words:*trailer, agricultural machinery, towed machinery, suspension, market share*

COMPARABLE VALUATION OF THE AGRI-FOOD AND OTHER MANUFACTURAL SECTORS IN N. GREECE AND S. BULGARIA - THE ENERGY CONTRIBUTION TO THE IMPROVEMENT OF THEIR ENVIRONMENTAL CONDITION AND SUSTAINABILITY

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Abstract. *For the comparable valuation of the manufactural activities between the examined regions and sectors, methods of statistical analysis are used to define significant differences in terms of competitiveness, environmental load, sustainability and eco-productivity. The data were obtained from manufacturing industries (Small and Medium Enterprises) operating in Northern Greece and South Bulgaria. The statistical analysis is based on available emergy indices produced after an emergy analysis. These indices are the Emergy Yield Ratio (EYR), which expresses the competitiveness, the Environmental Load Ratio (ELR), which expresses the environmental impact, the Emergy Index of Sustainability (EIS), which expresses the average degree of sustainability and the Emergy eco-Productivity Index (EPI), which expresses the influence of the monetary, non-monetary and renewable sources, in the final economic product. The results derived after the statistical analysis show that: (a) no statistical differences were found between the manufacturing sectors examined, (b) the competitiveness of the manufacturing sector in Bulgaria significantly surpass that of Northern Greece, under the current conditions in terms of labor and services compensation, (c) an elasticity of the environmental consciousness exists in Bulgaria in contrast to that of Northern Greece, (d) the low labor compensation does not lend any significant superiority to Bulgaria in terms of the sustainability of its manufacturing industry, (e) from the eco-productivity statistical analysis become clear that the three main production factors, the labor, capital and energy, are better exploited in Northern Greece than in Bulgaria Finally, proposals for further research work are suggested, since the results of this investigation are used to propose scenarios for a better management of the available energy sources, renewable and non-renewable as well as for the improvement of environmental conditions and the increase of the sustainability of the examined manufacturing sectors.*

Key words: *Emergy indices, Competitiveness, Environmental load, Sustainability, Eco-productivity*

NEW CURRICULA AND TEACHING PROGRAMMES ON SUSTAINABLE AGRICULTURE FOR ADVANCING THE SKILLS OF AGRICULTURAL OPERATORS

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Abstract. *In the present paper, the main results achieved so far by the European Project: "Skills Alliance for Sustainable Agriculture - SAGRI" are presented. SAGRI is a project financed by the Erasmus+ Programme of the European Commission aimed to give a decisive answer to the request of better trained farmers, agricultural workers and extension staff, thanks to structuring specific courses aimed to increase their knowledge, competence and skills in the field of agro-environmental technology for sustainable agriculture. Through the institution of suitable concerted and standardized study curricula and relevant teaching programmes specialized into the most recent developments of science and technology, the SAGRI Project is aimed to increase the technological level for agricultural operators. The official certification of the SAGRI courses will make agricultural operators even more employable, thanks to an enhanced mobility across EU countries, since their own competences will be recognized under the framework of the SAGRI system.*

Key words: *Sustainable agriculture; new technologies; farmer skills; study curricula; SAGRI.*

SPECIFICITIES OF VASCULAR INJURIES IN AGRICULTURE

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Abstract. *Agricultural injuries have higher rate of incidence, higher than many other industries. Injuries in agriculture are often linked with massive destruction of the tissue, traumatic amputation of body parts, they are mutilants and involve more than one body system (musculoskeletal, nervous, vascular, etc) The risk of development of local or systemic infection is also augmented. The aim of the study was to show specificities and significance of vascular agricultural injuries Retrospective analysis of medical records of patients who suffered vascular injury in agriculture during period of 2005 til 2017, hospitalized at Clinic for vascular and endovascular surgery Clinical Centre of Serbia. This study provides epidemiological data of treated patients and injury statistics. The majority of study participants were middle aged males. It also provides vascular injury of upper or lower limbs and incidence of co-injuries. The agriculture industry has one of the highest rate of injuries, patients are often working part of population, and understanding of injury scenario, should enhance treatment, rehabilitation and outcome. This information should help in development and implementation of prevention programs and policies.*

Key words: *agricultural injuries, vascular injuries,*

SELECTED ANGLICISMS IN SERBIAN REGISTER OF AGRICULTURAL MECHANISATION IN FRUIT GROWING AND VITICULTURE

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Abstract. *The current paper focuses on an empirical study of selected Anglicisms found in the language register of agriculture mechanisation in fruit growing and viticulture. The aims of the study are to explore, classify and determine the frequency of their use in several glossaries according to the classification given by Prćić (2004). The results show that this register contains a considerable number of Anglicisms, fully or partially assimilated. The most common ones used in this specific language field, according to the figures, are obvious Anglicisms, which are more or less integrated in Serbian linguistic system with minor modifications. The number of hidden and raw Anglicisms is significantly smaller. Furthermore, calque, the literal translation of the term, is extensively used in Serbian; since the agricultural machines and the capital allowances are vehicles and tools used worldwide, the most pragmatic move in their nomenclature, especially when dealing with complex expressions, is to translate the original term in order to be recognisable in different languages.).*

Key words: *Anglicisms, agriculture, mechanisation, fruit growing, viticulture, calques*

SAFE DRIVING AND WORKING WITH AGRICULTURAL AND FORESTRY VEHICLES

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Abstract. *If we want to reduce the number of fatalities and injured people when driving and working with agricultural and forestry vehicles, we have to regulate the whole area of use such vehicles. First step for this are conformity assessment procedures before putting agricultural and forestry vehicles on the market to achieve that only approved vehicles will come to the market. At the moment of the registration procedure of these vehicles for the use on public roads and for work these vehicles have to be equipped with the equipment that is obliged and prescribed in the EU harmonised legislation and in the national legislation. In the exploitation this vehicles have to be in good condition that is checked with the periodical technical inspections. This area is well regulated and harmonised because it is prescribed in the EU legislation. And finally the police and different inspectorates perform the roadside inspections that check the technical condition of these vehicles at driving and also at work on the field. On the other side also the drivers of agricultural and forestry vehicles need education in order to recognise what is the proper use of these vehicles, where their limits are and how to recognise the moments where they are only one step from causing an accident. If all mentioned systems work properly there is a possibility to reduce the number of fatalities and injured people with such vehicles.*

Key words: *safety, legislation, agricultural vehicles, forestry vehicles, approval,*

TRACTOR ACCIDENTS IN RELATION TO THE CHARACTERISTICS OF THE AREAS IN AGRICULTURE OF SERBIA

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Abstract. *This article shows the profile of Serbia's agricultural production and documents important trends in fatalities and injuries that occur in its realization.*
Some of the dangers that occur in agriculture are related to plants, chemicals, noise, dust, exposure to the sun and working with animals, and a combination of these hazards that are found in agriculture, as well as the circumstances in which agricultural jobs are done, makes agriculture one of the most dangerous industries.
By analyzing the types of accidents that occurred in the study period, outside the public transport of the Republic of Serbia, it can be concluded that the type of accident with the largest percent in the total number of accidents, is overturning tractor or aggregated implements and other power machines. Falling of persons from the tractors, aggregated implements or other power machines on the move, is the second most common type of accident. The third in terms of the total number of accidents with tractors and other power machines, outside public transport areas, in agricultural production processes, are accidents with run over of tractor's wheels, other power machines and trailers. The following in terms of representation, in the processes of agricultural production, are accidents that occurred during interventions at the operation of machines (interventions on the connection-cardan shaft, moving parts of connecting machines and combines.
it can be concluded that during the research period, which lasted from 2005 to 2009, there were 7,528 accidents with tractors and other power machines, of which 6,625 accidents or 88% in public transport in the Republic of Serbia, and 903 accidents or 12% in the exploitation of tractors and other power machines outside public transport areas, that is, in the processes of agricultural production.
The highest number of accidents was recorded in Zlatibor, Moravica and Belgrade areas.

Key words: *accidents in agriculture, power machines, agricultural operations, maintenance, areas in Serbia.*

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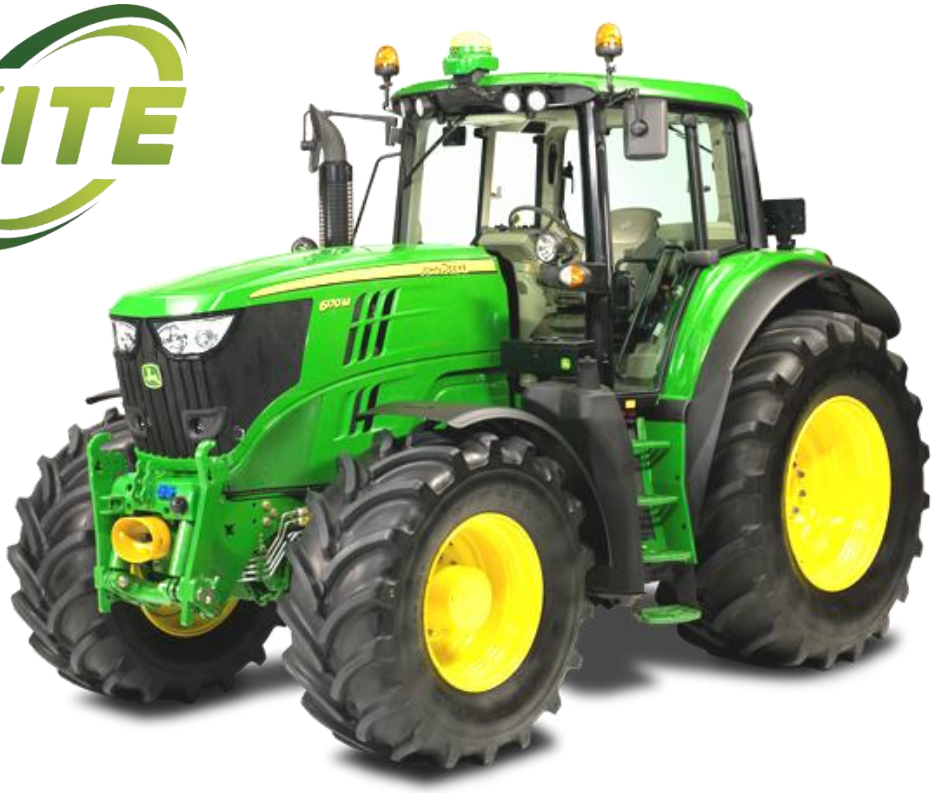

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